Comments on Proposed Surrogate Clearance Testing
for WTC-Related Contamination
Contract No. 68-C-02-060
Task Order No. 59

Comments Provided by Gary L. Ginsberg, Ph.D.
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Charge Question 1: The Confirmation Cleaning Study concluded that "asbestos air sampling was a conservative method for determining if additional cleaning was required." Given this conclusion and its supporting data in the Confirmation Cleaning Study and all other data sources, is the selection of asbestos as a surrogate for determining the risk from other contaminants supported? Please provide a detailed response, explaining the reasoning for your yes or no answer.

The selection of asbestos in air sampling, by itself, does **not** appear to be a sufficiently conservative surrogate test method. I have reached this conclusion by considering the following issues:

1. Does the existing sampling data at the pre-cleanup, interim cleanup, and post-cleanup stages support the notion that asbestos air sampling provides quantitative and qualitative results (needs cleanup vs. no cleanup needed) that are in step with what is found for the other key indicator analytes? ***Answer: Not necessarily.***

2. Are the cleanup criteria established for the key analytes appropriately risk-based so that any conclusion about a conservative testing surrogate has a firm underpinning in health protection? ***Answer: Yes, but one aspect of the equations (floor to skin transfer factor) appears to be particularly uncertain and should be reevaluated by USEPA.***

Issue 1

It would be ideal to have a robust dataset involving a large number of affected units in which the analyses have been completed for the full suite of WTC contaminants of potential concern (COPCs). This might foster regression or other type of analysis for the

purpose of documenting the correlation across contaminants. This quantitative approach would be particularly important in documenting whether there are instances in which certain COPCs might be high in the absence of substantial asbestos air contamination.

While desireable, the data needed for correlational analysis is quite limited. In the WTC Confirmation Cleanup Study, only 12 residential units were tested and cleaned one or more times. The before cleanup testing might be considered the most robust data for correlational analysis because of the fewer number of non-detects. However, most of this pre-cleaning round is invalid for the purpose of the current question because asbestos wipe, rather than air sampling was conducted. It is noteworthy that there was some correspondence between asbestos wipe results and the results for other wipe tests (lead, fiberglass) but this correlation was not completely consistent (Table 10 – Ranking of Residential units, Confirmation Cleaning Study). We don't know how the asbestos air sampling would have performed within this ranking framework and compared to these other analytes.

The post-cleanup sampling effort for the residential units in the Confirmation Cleanup Study did involve asbestos air testing in conjunction with tests for the other analytes. The greatest amount of data is available for the first post cleanup stage (13 units). As demonstrated in Table 12, 4 analytes (MMVF, alpha-quartz, dioxin, PAH) were below the cleanup target in most or all of the units after the first cleanup round. Two types of tests, asbestos in air and lead wipes, had a substantially higher failure rate, with this being most pronounced in the case of the asbestos results. This information, combined with the results from the second and third cleanup rounds, led the Confirmation Cleanup Study report to conclude that asbestos air sampling is a conservative testing approach.

Evaluation of the more detailed results presented in Table 11.2 (Exceedance Tables) for the residential units (summarized here in Table 1 below) demonstrates that there were no actual asbestos air exceedances in these residential samples, but that sample overload occurred in numerous locations, necessitating further cleanup. Glass fibers were elevated by a large margin in one case, which was also a case in which the asbestos sample was

overloaded. The only other analyte to show elevations in this round of residential testing was lead, with generally small elevations over the cleanup target. These lead elevations occurred in the presence of asbestos filter overload in 2 instances, and significantly there were 2 instances (Units 5A and 4D) where the lead exceedance occurred in the absence of an asbestos exceedance or overload. It should be noted that for some reason, the lead result for Unit 4D was rejected. However, that still leaves unit 5A with a lead wipe exceedance in conjunction with an asbestos air result that met the criterion.

Table 1
Summary of Post-First Cleanup Exceedance Results in Residential Units from Liberty St
(Abstracted from Table 11.2; Expressed as Fold Increase above Target)

Unit #	Asbestos Air	Dioxin	PAH	MMV F	Silica	Lead Wipe
4A	---[a]	---[a]	---[a]	---[a]	---[a]	---[a]
5C	Overload	---[a]	---[a]	1600x	---[a]	---[a]
5A	---[a]	---[a]	---[a]	---[a]	---[a]	1.66
4D	---[a]	---[a]	---[a]	---[a]	---[a]	1.12[b]
4C	---[a]	---[a]	---[a]	---[a]	---[a]	---[a]
4B	---[a]	---[a]	---[a]	---[a]	---[a]	---[a]
4A	Overload	---[a]	---[a]	---[a]	---[a]	---[a]
3D	Overload	---[a]	---[a]	---[a]	---[a]	---[a]
3C	Overload	---[a]	---[a]	---[a]	---[a]	1.08
3B	Overload	---[a]	---[a]	---[a]	---[a]	2.06
3A	Overload	---[a]	---[a]	---[a]	---[a]	---[a]
2B	---[a]	---[a]	---[a]	---[a]	---[a]	---[a]
2A	Overload	---[a]	---[a]	---[a]	---[a]	---[a]

[a]Sampled but no exceedance.
[b]Result reported but rejected.

The commercial units and common areas at the Liberty Street site were tested for the above analytes, including asbestos in air, both before and after cleanup. These results were not included in Tables 12 or 14 of the Confirmation Cleaning Study, which are the key tables being put forward to support asbestos air sampling as an acceptable surrogate test method. Table 2 below summarizes the commercial/common area results.

Table 2
Exceedances at Non-Residential Locations in Liberty Street Building
(Abstracted from Table 11.2, Exceedances shown as fold increase above cleanup target)

Location	Test Round	Asbestos Air[a]	Dioxin	PAH	MMVF	Silica	Lead Wipe
Chiropractor	Pre-cleanup	---[b]	---[c]	---[c]	---[c]	---[c]	9.7
	Post – Test A	Overload	---[c]	---[c]	---[c]	---[c]	4.2
	Post – Test B	Overload/43	---[c]	---[c]	3900	---[c]	14
	Post – Test C	Overload/3.7	---[c]	---[c]	---[c]	---[c]	---[c]
	Post – Test D	---[c]	---[c]	---[c]	---[c]	---[c]	---[c]
	Post – Test E	---[c]	---[c]	---[c]	---[c]	---[c]	38
Barber Shop	Pre-water wipe	---[c]	---[c]	---[c]	---[c]	---[c]	1.7
Mattress Store	Pre-cleaning	Overload	---[c]	14	5700	---[c]	2.3
	Post-Test A	Overload	---[c]	---[c]	---[c]	---[c]	1.7
	Post-Test B	Overload	---[c]	---[c]	---[c]	---[c]	3.4
	Post-Test C	2.2	---[c]	---[c]	---[c]	---[c]	---[c]
	Post-Test D	---[c]	---[c]	---[c]	---[c]	---[c]	---[c]
	Post-Test E	---[c]	---[c]	---[c]	---[c]	---[c]	1.5
Liberty St Staircase	Post-1st Cleaning	---[c]	---[c]	---[c]	---[c]	5.5	---[c]
LemonGrass	Post-1stcleaning	Overload	---[c]	---[c]	---[c]	---[c]	6.6
LemonGrass Basement	Post 1stcleaning	---[c]	---[c]	---[c]	---[c]	---[c]	---[c]
FoodExchange	Post 1stcleaning	---[c]	---[c]	---[c]	---[c]	---[c]	6.4
5th Floor Hall	Post 1stcleaning	Overload	---[c]	---[c]	---[c]	---[c]	---[c]

[a]PCMe test results.
[b]PCMe testing was below target, but screening asbestos air test via PCM did show an elevation in one of two samples.
[c]Sampled but no exceedance.

These results show 9 asbestos air samples with a numeric exceedance or filter overload, which is consistent with the residential unit sampling in that this method yielded the greatest number of results that triggered further cleanup. Importantly, there were no exceedances of the dioxin target and only one of the PAH target. While the PAH wipe sample exceedance was large, it occurred in a location that needed cleanup based also on

the asbestos air result. A similar situation exists with the 2 exceedances seen for glass fibers: large exceedances but also occurring only where the asbestos in air result would trigger remediation anyway. A single exceedance for crystalline silica was found, that in the Liberty St. staircase, and this occurred in the absence of an asbestos or any other exceedance. The Confirmation Cleaning Study discounted this result because it was such a unique finding. The lead results indicate numerous exceedances. In 5 of the 11 lead exceedances, asbestos in air was not also elevated or overloaded. This is in contrast to the results for the residential units in which asbestos air samples were elevated or overloaded in nearly all cases where lead was elevated.

When combining the residential and non-residential sampling results for the Liberty Street building, one obtains elevated asbestos in air results in the majority (16 of the 23 or 70%) of the sampling events where exceedances were found. However, this is not as high a percentage as one would like when relying upon a surrogate test as an index of clearance from WTC-related contamination and public health protection.

In all cases except one, the analyte not in step with the asbestos in air results was lead. This may indicate that there are contributions to the measured lead levels in these residential and commercial spaces that are not related to fallout from the WTC. This would be most plausible if the building was built before 1978 and contains lead paint in disrepair. In this event, lead exceedances might occur even in spaces cleared of WTC contamination due to continued peeling of paint. However, I could not find mention of the construction date of the building or whether it contains lead paint, and if so, what was the condition of that paint. Further, the time frame between initial cleaning and retesting may be too short for significant lead recontamination from local painted surfaces, especially since the building was unoccupied during this time interval. Additional support for the concept that lead is primarily from WTC fallout rather than from local paint is the ranking data presented in Table 10 of the Confirmation Cleaning Study report. That table shows that when units were compared based upon their contamination rank score, that there was a generally good rank correlation between the asbestos wipe and lead wipe results (i.e., where lead was high, asbestos was high and vice versa). This

would suggest that the primary source of both analytes is the same, presumably fallout from the WTC explosion.

The other possible reason for the lead-only exceedances is that there had been recontamination of surfaces with WTC-related material but that material had somehow become enriched in lead or lead was more readily detected in certain cases than asbestos in air. If these are the reasons for the lead-only exceedances, then it raises the concern that asbestos in air testing alone is inadequate to ascertain the continuing presence of WTC contamination of public health significance.

Other reports which contain asbestos in air via PCMe testing (the proposed surrogate method) and other analytes are generally consistent with what was described above for the Residential Confirmation Cleaning Study. The "World Trade Center Residential Dust Cleanup Program" draft final report dated March 2004 (prepared by USEPA, Region 2) describes a residential cleanup program throughout lower Manhattan. Pre-cleanup and post-cleanup surface wipe sampling in conjunction with asbestos in air sampling was available for a subset of 214 residential units. The report documents that while the cleanup procedure was able to reduce lead dust loading by a large factor, 3% of the samples coming from 5 units were still above the lead wipe cleanup target. In contrast, the asbestos PCMe results indicated a somewhat greater cleanup success with 99% of the samples meeting the asbestos in air target after one cleanup round. These data suggest that, once again, lead exceedances occurred in locations where the proposed surrogate test method, asbestos in air via PCMe analysis, did not reveal an exceedance or overload.

It is also important to note that the March 2004 report demonstrates that both pre-cleanup and post-cleanup testing for dioxin found dust wipe samples to be uniformly below the health-based benchmark of 2 ng/m^2. This is consistent with the Residential Confirmation Cleaning Study and with another report involving WTC contaminant sampling, the "Characterization of Particles Found in Apartments after Destruction of the World Trade Center" (Chatfield and Kominsky, Oct. 2001). This latter report describes an exploratory sampling effort in two lower Manhattan buildings soon after the WTC

disaster. One of the buildings (South End Ave.) was particularly close to ground zero. The limited sampling found asbestos and lead to be elevated in this building but the dioxan/furan results failed to find levels above that which can be found in background locations.

Thus, in summary, the sampling data that I reviewed for this scope of work would suggest that asbestos in air and lead surface wipe testing are key indicators of WTC contamination of buildings. However, analytes such as dioxins, PAHs, other metals, silica, or glass fibers may not be as commonly elevated, particularly post-cleanup, and would not need to be included in new sampling programs.

Issue 2

The May 2003 reported titled "World Trade Center Indoor Environment Assessment: Selecting Contaminants of Potential Concern and Setting Health-Based Benchmarks" was reviewed to determine the adequacy of the cleanup targets and whether the inclusion/exclusion of COPCs was done in a reasonable and health-protective manner.

The report provides extensive justification for the exclusion of a large array of analytes from the COPC list on the basis of the analytes being too volatile to remain in the air or settled dust for extended time periods, or being of minor quantitative importance in the particulate cloud emanating from the fires as measured in early air and dust sampling, or due to the lack of sufficient toxicity information. The final COPC list is well justified and does not appear to be missing any key analytes.

The established target of 1 in 10^4 cancer risk for individual carcinogens may appear to be underconservative given that this is really the upper end of what might be considered an acceptable risk range and does not take into account the addition of risk across carcinogens that may act on similar tissues. However, the 1 in 10^4 cancer risk target for dioxins, PAHs and asbestos, the 3 carcinogenic COPC analytes, is necessitated by: a) asbestos in air: achievable analytical detection limits and background ambient conditions;

b) PAHs in dust: achievable detection limits; c) dioxins: background concentrations of dioxins in dust. The background data come largely from the WTC Background Study, USEPA, 2003, which was designed specifically to assess background concentrations of COPCs in a part of Manhattan unaffected by the WTC fires. These considerations indicate that the 1 in 10^4 cancer risk target is justified on practical grounds. It is also reasonably health protective. For example, with respect to PAHs, the cancer slope factor for benzo(a)pyrene was applied to the total PAH load which is conservative given that benzo(a)pyrene is at least 10 fold more potent than most of the other carcinogenic PAHs. A 10^{-4} risk target for the other analytes, asbestos and dioxins is still well below levels that have actually been demonstrated to cause cancer in animals or humans, and there are no known interactions between PAHs, dioxins and asbestos that would imply synergism.

The exposure equations describing transfer of WTC-contaminated dust from floors to skin utilized fraction transferred (FTSS, unitless) value of 10% from carpets and 50% from hard surfaces, which is based upon a relevant dataset involving hand press experiments assessing particle transfer to dry skin. However, transfer to moistened hands would be somewhat greater, which could be the more prevalent case for toddlers who have frequent hand-to-mouth activity. The datasource for this estimate (Rodes, et al., 2001) did find higher fraction transfer onto moistened hands but USEPA judged these data to be less reliable and so used the dry hand data instead. This would be expected to have a limited impact on lifetime cancer risk given the brief period of time during which the moistened hand factor would be relevant. However, USEPA's proposed child-specific cancer risk guidelines acknowledges greater cancer potency during early life than in older children or adults. This creates the possibility that using dry hand data for fraction transferred could be underconservative for young children's cancer risk.

The transfer coefficient (TC) term represents the rate of skin contact with the floor. The value adopted of 1200 cm^2/hr for toddlers is well below the Office of Pesticide Program default of 6000 cm^2/hr because the OPP value is a high end estimate assuming minimal clothing protection and high activity levels. A backfitting method was used to estimate a value of 1200 cm^2/hr which depends upon other uncertain values (e.g., dust loading on

floor surface, exposed skin surface area) and limited data on dust load per cm^2 skin in children. However, the assumed value for exposed skin surface area for young children of 5000 cm^2 (50% of surface area of 7-8 yr olds) is conservative enough to make it likely that dermal exposure to dust particles will not be underestimated.

Regarding dust ingestion, the transferable residue from floor to fingers is dependent upon the fraction transferred, which as described above, the default assumptions may be underconservative for moistened hands. Other features of this model would appear to be highly uncertain including the hand surface area assumed to be in contact with the mouth (3 fingers or 15cm2 for toddlers), frequency of hand to mouth events (9.5/hr, 12 hr/d) and saliva extraction factor (50% assumed). While it is concievable that the surface area in contact with the mouth could be an underestimate for some children, especially considering the ingestion of particles from the mouthing of toys as well, the other parameters, frequency of hand to mouth events and saliva extraction factor would appear to be conservative and counter-balance the possible underconservatism in the hand surface area.

Overall, risks associated with the dust exposure pathway would appear to be an uncertain calculation. When confronted with such uncertainty, risk assessments typically use high end bounding assumptions so as to not underestimate what the true exposure/risk might be. In the WTC cleanup criteria calculations for surface dust, it would appear that the assumption of dry hands might be an important underconservatism, especially since toddlers are assumed to play on carpeting the majority of the time and carpeting only had a 10% surface to skin transfer assumption. Thus, there is considerable room for increase in this assumption if warranted based upon a closer inspection of the data from Rodes, et al., 2001. Thus, I recommend that this issue be revisited by USEPA, with the use of the dry hands data either further justified or the implications of using the moistened hand data on cleanup criteria explored. This issue should also be considered with regards to the lead in dust wipe cleanup target of 25 ug/ft^2 as it was in part, justified by assessing children's floor dust lead exposure and blood lead impact using the IEUBK model. Aside from the issue of dry vs moistened skin uptake of dust, I consider the derivation of

cleanup criteria for asbestos in air and COPCs in dust wipe samples to be generally adequate to protect public health at the designated risk target (10^{-4} or HI=1).

Charge Question #2: Do other contaminants that were measured in the Confirmation Cleaning Study provide equally good or better surrogates for determining the risk from other contaminants? If yes, please describe in detail which contaminants you would consider and why. If no, provide justification for your respone.

As described above in tables and text, the asbestos in air (PCMe) technique did not always cover exceedances for other COPCs, particularly with respect to lead dust wipe results. While lead dust wipes should not be considered as a replacement for asbestos in air, I think the data point to the need for two surrogates (asbestos in air, lead dust wipe) to be run in tandem. If the lead dust wipe is the only analyte that is elevated, then other factors such as the presence of lead paint in the unit, condition of the paint and lead dust levels outside the unit (hallway and street dust), may need to be taken into consideration to determine if the lead hazard stems from WTC or other sources, and whether re-cleaning this single apartment would lead to meeting the health-based criterion over the long term.

Charge Question #3: Do the reviewers know of any other contaminants associated with the World Trade Center that were not included I the COPC document or the Confirmation Cleaning Study that may serve as a surrogate for determining the risk from other contaminants? If so, please provide the details regarding these contaminants and the reasons why they should be considered. Provide citations for any references mentioned, and or submit hard copies of the referenced documents.

I do not know of any other candidate compounds to use as a cleanup test surrogate. The COPC screening process was thorough and well justified, with the test results pointing to asbestos in air and lead wipe testing as indicative of the need to reclean residential or commercial spaces.

NOTE: All documents cited in this review are either USEPA documents directly related to the WTC project or are cited within such documents. Since I have not cited any new publications, I have not included a bibliography or attached hard copy.